NAS-IR-25082503
November 4, 1986

U.S. Department
of Transportation

**Federal Aviation
Administration**

Interface Requirements Document

WEATHER COMMUNICATIONS PROCESSOR AND
AUTOMATED WEATHER OBSERVING SYSTEM/DATA ACQUISITION SYSTEM INTERFACE

(WCP/ADAS)

NAS-IR-25082503
November 4, 1986

INTERFACE REQUIREMENTS DOCUMENT

APPROVAL SIGNATURE PAGE

Weather Communciations Processor (WCP) and
Automated Weather Observing System/Data Acquisition System (ADAS)
WCP/ADAS

APPROVAL SIGNATURES

PARTICIPANT	NAME	DATE
APM-640	G. Barboza	11/4/86
APM-650	for L. Gumina	11/4/86
AES-120	for J. Nager	11/4/86

REVISION RECORD

REVISION LETTER	DESCRIPTION	DATE	ENTERED BY

EFFECTIVITY

LOCATION	INTERFACE EFFECTIVITY DATE

Alphabetical Listing by Facility

1.	*Aeronautical Center,	Oklahoma City, OK
2.	Albuquerque ACF,	Albuquerque, NM
3.	Anchorage ACF	Anchorage, AK
4.	Atlanta ACF,	Hampton, GA
5.	Boston ACF,	Nashua, NH
6.	Chicago ACF,	Aurora, IL
7.	Cleveland ACF,	Oberlin, OH
8.	Denver ACF,	Longmont, CO
9.	*FAA Technical Center	Atlantic City, NJ
10.	Fort Worth ACF,	Euless, TX
11.	Honolulu ACF,	Honolulu, HI
12.	Houston ACF,	Houston, TX
13.	Indianapolis ACF,	Indianapolis, IN
14.	Jacksonville ACF,	Hilliard, FL
15.	Kansas City ACF,	Olathe, KS
16.	**Long Island ACF,	Jamaica, NY
17.	Los Angeles ACF,	Palmdale, CA
18.	Memphis ACF,	Memphis, TN
19.	Miami ACF,	Miami, FL
20.	Minneapolis ACF,	Farmington, MN
21.	New York ACF,	Ronkonkoma, NY
22.	Oakland ACF,	Fremont, CA
23.	Salt Lake City ACF,	Salt Lake City, UT
24.	Seattle ACF,	Seattle, WA
25.	Washington ACF,	Leesburg, VA

*Support Location
**WCP Not Planned for this Location

TABLE OF CONTENTS

FIGURES

TABLES

1. SCOPE

1.1 Scope. This Interface Requirements Document (IRD) defines the requirements for the interface between the Weather Communications Processor (WCP) and the Automated Weather Observing System/Data Acquisition System (ADAS). The interface requirements are organized using the seven-layer International Organization for Standardization (ISO) Information Processing Systems-Open Systems Interconnection (OSI)-Basic Reference Model (ISO-7498), to provide a logical and modular arrangement of the functions and procedures that are essential to the specification of the interface. This document addresses the application, presentation, session, and transport layers of the model. The network, data link, and physical layers are addressed separately in NAS-IR-21020000 for end state and NAS-IR-43020001 for a transition interface if required.

1.2 Subsystem/equipment item responsibility list.

Item	Name	Responsible Program Office
ADAS	AWOS Data Acquisition System	APM-650
WCP	Weather Communications Processor	APM-640

2. APPLICABLE DOCUMENTS

2.1 Government documents. Unless otherwise specified, the following document of the issue in effect on the date of this IRD form a part of this IRD to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this IRD, this IRD shall be considered the superseding requirement.

OTHER PUBLICATIONS:

Federal Aviation Administration (FAA) Interface Requirements Document

NAS-IR-21020000	Local Communication Network (LCN) User System Communications Interface Requirement (Draft)
NAS-IR-43020001	National Airspace Data Interchange Network X.25 Packet Mode Users (Draft)

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specified procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Non-Government documents. Unless otherwise specified, the following documents of the issue in effect on the date of this IRD form a part of this IRD to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this IRD, this IRD shall be considered the superseding requirement.

STANDARDS:

International Telephone and Telegraph Consultive Committee (CCITT)

CCITT Recommendation X.224	Transport Protocol Specification for Open System Interconnection for CCITT Application

International Organization for Standardization (ISO)

ISO 7498	Information Processing System - Open System Interconnection - Basic Reference Model

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

2.3 Related IRDs. Not applicable.

3. INTERFACE REQUIREMENTS

3.1 General requirements. Data collected by the ADAS from multiple surface weather observing stations shall be made available by the ADAS to the WCP. The message rate between an ADAS and its primary WCP shall be a maximum of 137 messages per minutes. Each message shall contain a maximum of 1.6 kilobits. The logical interface between the WCP and ADAS is shown in Figure 1.

3.2 Functional requirements. This section describes the various protocol layers and data formats that are applicable to this interface. Figure 1 illustrates the layers and their logical interface between the WCP and the ADAS.

3.2.1 Application layer.

3.2.1.1 Overview. The application layer defines the procedures for the exchange of data between WCP and ADAS. The functions provided by this layer enable the distribution of surface weather observation data on a scheduled basis. All data exchange between the two interfacing systems will take place, using Application Data Units (ADU). This layer uses the services provided by the transport layer to transmit and receive the ADUs.

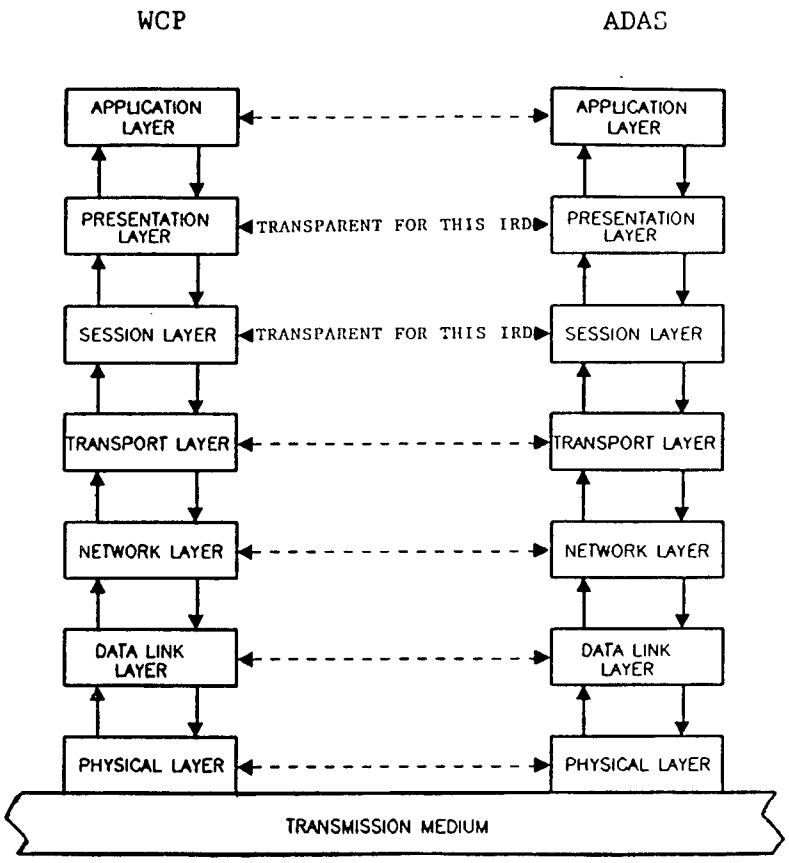


Figure 1. WCP/ADAS Logical Interface

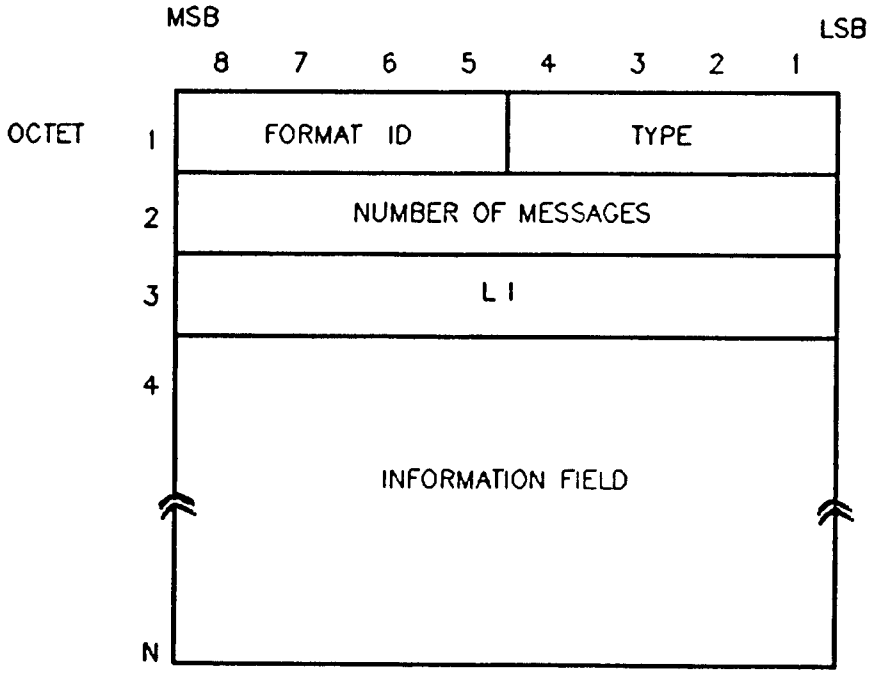
3.2.1.2 Functions of the application layer.

3.2.1.2.1 Connection establishment. ADAS shall be responsible for establishing the application-level connection with the WCP.

3.2.1.2.2 Data transfer. The application layer shall provide the data-transfer function, enabling the WCP to receive surface weather data transmitted on a scheduled basis by the connecting ADAS.

3.2.1.3 Elements of protocol.

3.2.1.3.1 Application data unit transfer. All data that are transferred between the WCP and ADAS application entities shall conform to the ADU format shown in Figure 2.



Octet	Bit	Data
1	1-4	Type - See Table I
	5-8	Format ID - See Table I
2	1-8	Number of Messages - specifies the number of automated surface weather observations in the data transmission
3	1-8	LI (Length Indicator) - specifies the length of the information field.
4..N	Variable	Information field - contains automated surface weather observing data or error message.

Figure 2. General ADU Block Format

3.2.1.3.2 Data transfer. The weather data transmission from the interfacing ADAS shall be contained in the DT ADU, as shown in Figure 3. The data from multiple automated surface weather observing stations shall be concatenated using the Length Indicator (LI) field.

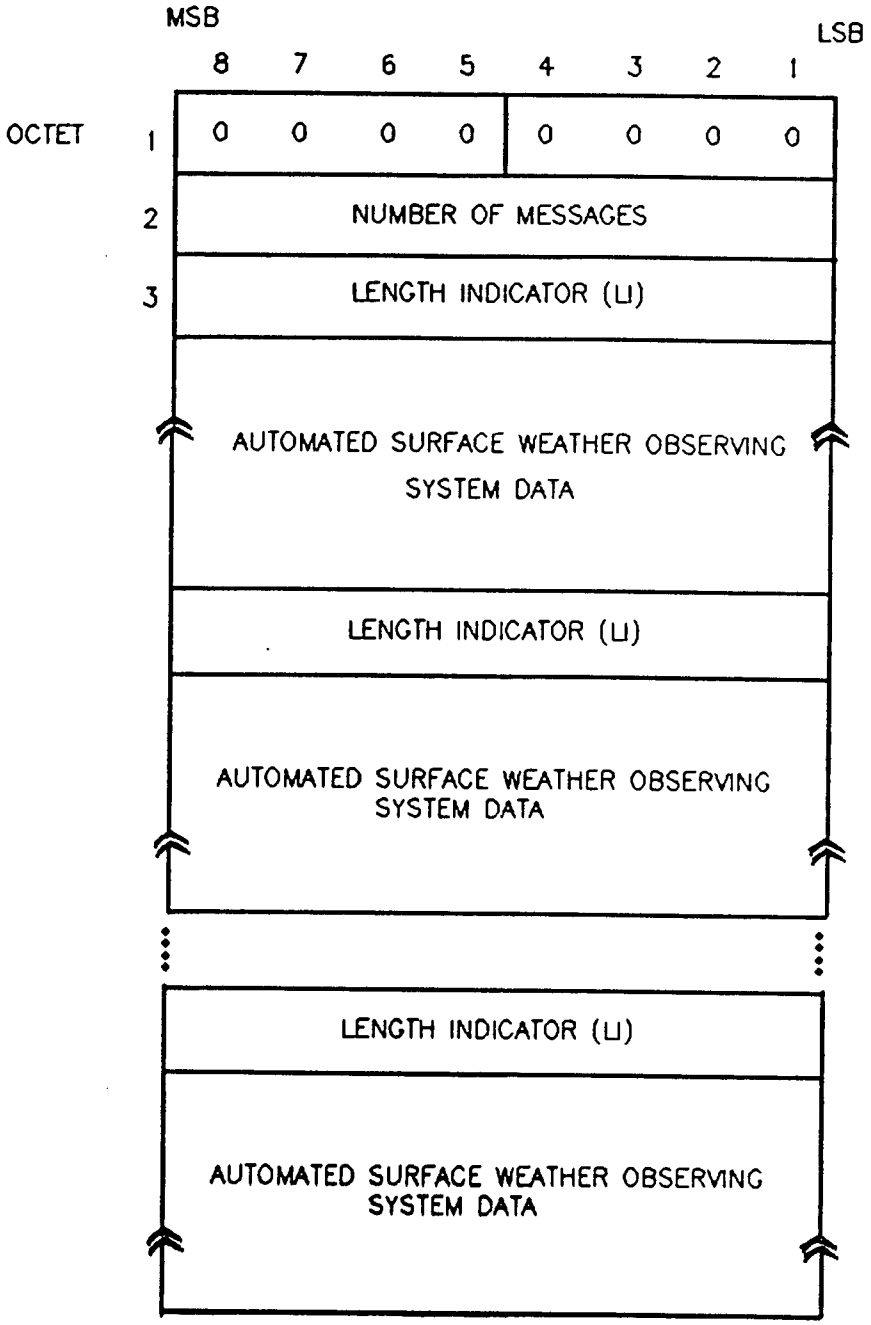


Figure 3. DT ADU Format

Table I ADU Format ID and Type Field Codes

Message		Format ID	Type
Data (DT) Transfer	Scheduled	0000	0000
Error (ERR)	Time Out of Range	0010	*
	Invalid Station ID	0010	*

*Type code to be specified in Interface Control Document (ICD)

3.2.1.3.3 Error handling. This interface will have an error (ERR) handling capability as shown in Table I. The ERR ADU shall be formatted as shown in Figure 4, with the error condition being indicated by the appropriate error code in the Type field. The ADU in error may be wholly contained in the information field of the ERR ADU.

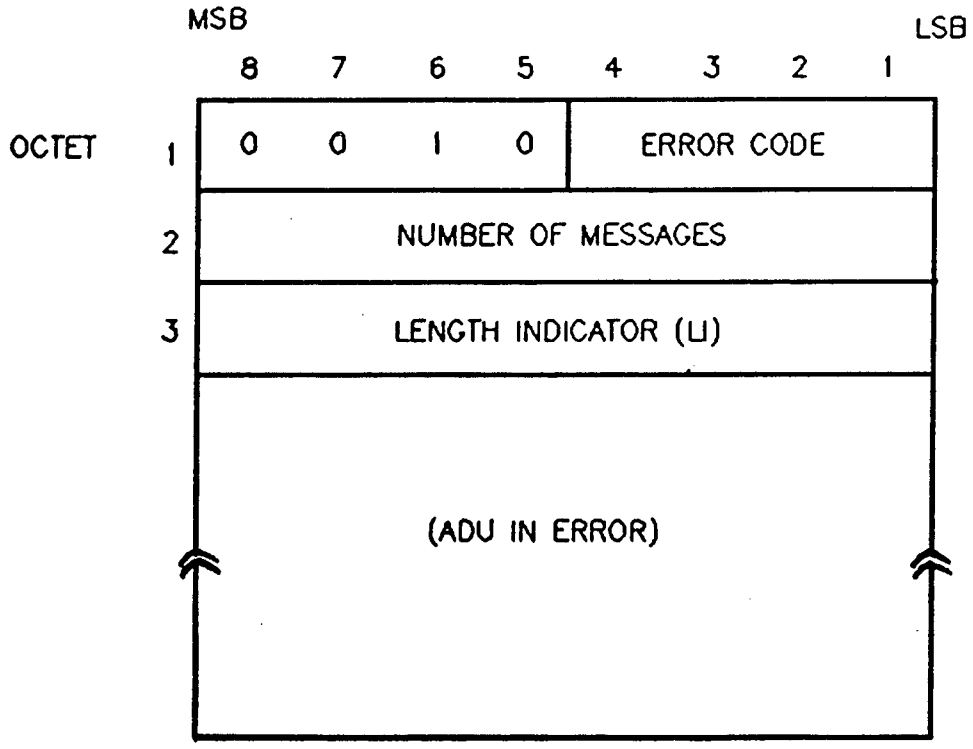


Figure 4. ERR ADU Format

3.2.2 Presentation layer. This IRD imposes no explicit requirements in the presentation layer.

3.2.3 Session layer. This IRD imposes no explicit requirements in the session layer.

3.2.4 Transport layer.

3.2.4.1 Overview. The transport layer defines the procedures for the establishment of end-to-end connection and data transfer that makes optimum use of the services provided by the network layer.

3.2.4.2 Function of the transport layer. The transport layer provides the means to negotiate the class of procedures to be used for data transmitting and receiving data between two transport entities.

This layer shall support the Class 4 procedure of the ISO transport protocol specified in CCITT Recommendation X.224. Class 4 provides the capability to detect and recover from errors which occur as a result of a low grade of service availability from the network service provider. The limit of errors to be detected include: Transport Protocol Data Unit (TPDU) loss, TPDU delivery out of sequence, TPDU duplication, and TPDU damage.

3.2.4.3 TPDU Structure. The various functions of the transport protocol layer shall be performed by exchanging a TPDU between the peer transport layers of the interfacing WCP and ADAS. The TPDU shall be composed of a collection of octets, encoded and formatted as detailed in CCITT Recommendation X.224. A list of all TPDUs and the associated TPDU code that shall be supported by this interface under the stated class of service is provided in Section 13 of Recommendation X.224.

3.2.4.4 TPDU size. The maximum allowable TPDU size shall be negotiated at the time of establishing a transport connection. The TPDU size shall be specified within the variable part of the CR TPDU as an optional parameter, and shall be selectable from the values: 128, 256, 512, 1024, 2048, 4096 and 8192. The default value shall be 128 octets.

3.2.4.5 Configurable parameters. The configurable parameters required to support the transport protocol are defined as follows:

a) CR-timer: this timer is associated with the CR TPDU transmitted by the transport entity. The timer shall be reset and started when the CR TPDU is transmitted or retransmitted, and stopped when the connection is accepted, refused, or unsuccessful.

b) CR-count: this is the retry count for retransmitting an unacknowledged CR TPDU.

c) N-TPDU: this is the negotiated maximum size of the TPDU.

Table II defines the range, resolution, and default setting of these configurable parameters.

Table II Configurable Transport Protocol Parameters

Parameter	Lower Limit	Upper Limit	Resolution	Default
CR-timer (s)	0	120	0.5	10
CR-count (tries)	1	16	1	3
N-TPDU (octets)	128	8,192	*	128

*Should be selectable among 128, 256, 512, 1,024, 2,048, 4096, 8192.

3.2.5 Network layer. Network layer requirements shall be in accordance with NAS-IR-21020000 for interconnection of the WCP and ADAS via LCN. When the interconnection is via NADIN II the Network layer shall be in accordance with NAS-IR-43020001.

3.2.6 Data link layer. Data link layer requirements shall be in accordance with NAS-IR-21020000 for interconnection of the WCP and ADAS via LCN. When the interconnection is via NADIN II the Data link layer shall be in accordance with NAS-IR-43020001.

3.2.7 Physical layer. Physical layer requirements shall be in accordance with NAS-IR-21020000 for interconnection of the WCP and ADAS via LCN. When the interconnection is via NADIN II the Physical layer shall be in accordance with NAS-IR-43020001.

3.3 Physical requirements. All physical requirements shall be in accordance with NAS-IR-21020000 for end state. All physical requirements shall be in accordance with NAS-IR-43020001 for transition.

4. QUALITY ASSURANCE PROVISIONS

4.1 General. The interface requirements that are specified in section 3 of this IRD shall be verified by the methods stipulated in paragraph 4.4 and as applicable during the verification phases described in paragraph 4.5. The Verification Requirements Traceability Matrix, Table III shall be used to verify compliance.

4.2 Responsibility for verification. Responsibilities for verification shall be in accordance with the Statement of Work.

4.3 Special test support requirements. There are no special test support requirements imposed by this IRD.

4.4 Verification methods and rationale. The methods of verification that are identified in this IRD are: Test (T), inspection (I), and demonstration (D). Definitions of these verification methods are presented in section 6 of this IRD.

The rationale applied to the method selection is as follows:

Where practical, all functional performance requirements shall be verified by Test. This will provide a measured performance of specific requirements. If Test is not practical other methods of verification are evaluated and the method or methods providing the most thorough evaluation are used. Verification of each requirement shall be accomplished at the lowest possible verification level or phase.

4.5 Verification phases. As a minimum, one of three levels of verification shall be performed to demonstrate that the requirements as described in section 3 have been met. These three levels are: subsystem acceptance level, system integration level and site acceptance level. The definitions of the verification levels are presented in section 6 of this IRD.

4.6 Quality conformance inspections. The Verification Requirements Traceability Matrix (VRTM) presented in Table III lists the requirements to be verified, the phases or levels at which verification will occur, and the methods of verification to be used. Compliance with section 3 shall be evaluated in terms of the VRTM.

4.7 Verification requirements. There are no additional verification requirements imposed by this IRD.

Table III Verification Requirements Traceability Matrix

Section 3. Requirements Paragraph Reference for Document		Verification Level and Method			Remarks
		Subsystem Level	Integration Level	Site Level	
3.	Interface Requirements				Title
3.1	General Requirements	X	D	D	
3.2	Functional Requirements				Description
3.2.1	Application Layer				Title
3.2.1.1	Overview				Description
3.2.1.2	Functions of the Application Layer				Title
3.2.1.2.1	Connection Establishment	D	D	D	
3.2.1.2.2	Data Transfer	D	D	D	
3.2.1.3	Elements of Protocol				Title
3.2.1.3.1	Application Data Unit Transfer	T	T	X	
3.2.1.3.2	Data Transfer	T	T	X	
3.2.1.3.3	Error Handling	T	T	X	
3.2.2	Presentation Layer	X	X	X	
3.2.3	Session Layer	X	X	X	
3.2.4	Transport Layer				Title
3.2.4.1	Overview				Description
3.2.4.2	Function of the Transport Layer	T	T	D	
3.2.4.3	TPDU Structure	T	T	X	
3.2.4.4	TPDU Size	T	T	D	
3.2.4.5	Configurable Parameters	T	T	D	
3.2.5	Network Layer	T	T	D	
3.2.6	Data Link Layer	T	T	D	
3.2.7	Physical Layer	T-I	T-I	I	
3.3	Physical Requirement	T-I-D	T-I-D	I-D	

X = Not Applicable; I = Inspection; D = Demonstration; T = Test

5. PREPARATION FOR DELIVERY

This section is not applicable to this IRD.

6. NOTES

6.1 Definitions.

The following definitions apply to the terms and acronyms used in this IRD:

6.1.1 Area Control Facility (ACF). An evolutionary consolidation of the existing Air Route Traffic Control Center (ARTCC), Terminal Radar Approach Control (TRACON), and Terminal Radar Approach Control in the Tower Cab (TRACAB) facilities. ACFs will control enroute as well as terminal airspace.

6.1.2 Addresses. A special sequence set of bits or characters assigned to a specific terminal within a communications network, or on a multi-terminal circuit, for the purpose of routing messages to a specific destination(s).

6.1.3 Demonstration. Demonstration is a method of verification where qualitative determination of properties is made for an end-item, including software and/or the use of technical data and documentation. The items being verified are observed, but not quantitatively measured, in a dynamic state.

6.1.4 Inspection. Inspection is a method of verification to determine compliance without the use of special laboratory appliances, procedures, or services, and consists of non-destructive static-state examination of the hardware, software, and/or technical data documentation.

6.1.5 Interface. A point where two systems, or activities, interact. A common boundary.

> Example: In a communications system, an interface is where a hardware device (e.g. computer) and a communication circuit come together.

6.1.6 Invalid station ID. A data transfer block error detected by an application program that finds a station ID inconsistent with valid station IDs as contained in the tables of IDs that are available to the application program.

6.1.7 Local Communications Network (LCN). A special configuration of communications hardware, software, firmware, and circuitry designed to interconnect a wide variety of computer systems and communications devices within the ACF facilities.

6.1.8 System integration. This level of verification is conducted at the FAA Technical Center or key site. The verification will determine if the hardware to be deployed for site installation will perform in a National Airspace System (NAS) environment and in accordance with the NAS system level operational and functional requirements.

6.1.9 Network Layer. A specific interface level in the design of a network architecture provided by a set of operating procedures (protocols) based on a design standard, that will support compatibility between equipment providing data communications and information transfer services between two or more DTEs and two or more DCEs.

6.1.10 Octet. An octet is defined as an 8-bit byte.

6.1.11 Protocol. Any specific procedure in which precise rules are followed. Defined in communications hardware and software to describe the particular transmitting/receiving methodology being used (often in the form of a standards document).

6.1.12 Protocol, layered. A technique used in a communications network (e.g., LCN, NADIN II) that isolates the functions required in the network so that they may be set up (implemented) in a modular manner. Individual "layers" deal with the hardware, software, and coding schemes used for communications without requiring redesign of the entire network.

6.1.13 Signal timing. A series of electrical pulses (bits) produced by a timing circuit or "clock" used for the control of some of the components of a communication system. The timing signal "sets the pace" by which bits are transmitted between computer system and data communications equipments.

6.1.14 Signalling rate. Also transfer rate - the quantity of bits (data) which can be transmitted from one computer/communications device relative to a period of time.

6.1.15 Site acceptance. This level of verification is usually performed at the designated site. The verification portion of the subsystem installation and checkout will emphasize the demonstration to the overall system performance requirements. It includes the demonstration of an end-item, subsystem system final acceptance demonstrations and commissioning activities.

6.1.16 Subsystem acceptance. This level of verification is usually accomplished at the contractor's facility and culminates in the formal acceptance of contractual end item.

6.1.17 Test. Test is a method of verification wherein performance is measured during or after the controlled application of functional and/or environmental stimuli. Quantitative measurements are analyzed to determine the degree of compliance. The process uses laboratory equipment, procedures, items, and/or services.

6.1.18 Time Out of Range. A data transfer error (detected by an application program) where the specific time is inconsistent with the context of the data block.

6.2 Abbreviations and Acronyms.

ACF	Area Control Facility
ADAS	AWOS Data Acquisition System
ADU	Application Data Unit
ARTCC	Air Route Traffic Control Center
AWOS	Automatic Weather Observing System
CC	Connection Confirm
CCITT	International Telegraph and Telephone Consultive Committee
CR	Connection Request
D	Demonstration
DCE	Data Communications Equipment
DR	Disconnect Request
DT	Data
DTE	Data Terminal Equipment
ERR	Error
FAA	Federal Aviation Administration
I	Inspection (in relation to verification activities)
ICD	Interface Control Document
ID	Identifier
IRD	Interface Requirements Document
ISO	International Organization for Standardization
LCN	Local Communications Network
LI	Length Indicator
LSB	Least Significant Bit
MSB	Most Significant Bit
N	Negotiated Maximum Size (in Relation to TPDU) Number of Octets for Message Size (in Relation to ADU Information Field)
NADIN	National Airspace Data Interchange Network
NAS	National Airspace System
OSI	Open System Interconnection
T	Test
TPDU	Transport Protocol Data Unit
TRACAB	Terminal Radar Approach in Tower Cab
TRACON	Terminal Radar Approach Control
VRTM	Verification Requirements Traceability Matrix
WCP	Weather Communications Processor
X	Not Applicable